Market Instruments Options for

Reduced GHG Emissions from Agriculture

A Policy Issue Paper Prepared for the
Agriculture and Agrifood Climate Change Table

By

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Background

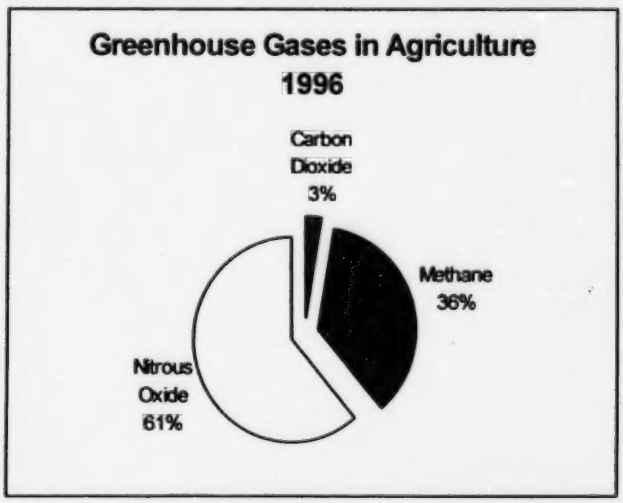
Market instruments have been used to achieve a variety of objectives in many policy areas. The paper will examine the possibility of using market instruments to assist in the reduction of greenhouse gases from agriculture.

To determine the effectiveness of market instruments in reducing greenhouse gases emissions three things need to be reviewed. The first step is to establish the types of greenhouse gas occurring in agriculture production and processing. Secondly, a review of the different types of market instruments is required. Finally, an analysis of the potential to use these market instruments in the reduction of the greenhouse gas emissions from agriculture is necessary. The results of the process will highlight the appropriate market instruments for the reduction of greenhouse gases in agriculture production and processing.

Types of Agricultural Greenhouse Gas Emissions?

Canadian emissions from agricultural sources contributed about 10 percent of the total greenhouse gas emissions (Canada Grain Council, 1998). Agriculture's emissions of greenhouse gases include Carbon Dioxide, Methane and Nitrous Oxide. Figure 1 outlines the percentage of each gas in agriculture emissions.

Figure 1 Percentage of Greenhouse Gas Emissions from Agriculture



Source: adapted from Canada Grain Council, 1998

The nitrous oxide (N_2O) emissions come from fertilizer application and cropping practices. Agriculture contributes approximately 49 percent of Canada's total emissions in N_2O. The trend for N2O emissions from agriculture is increasing due to the losses

from some fertilizing practices. For example, the application of Anhydrous Ammonia loses 1.63 percent of its nitrogen, while the next highest loss is from Ammonium nitrate, which loses 0.26 percent of its nitrogen (Environment Canada, 1997). While this does not appear significant, the application of Anhydrous Ammonia represents approximately 85 percent of the N_20 emissions from fertilizer use.

Methane (CH_4) emissions from agriculture in Canada are based on enteric fermentation and manure management. Enteric fermentation is the emissions from ruminant animals, which is a large source of methane in Canada. Enteric fermentation and animal wastes together contributed about 27 percent of Canada's methane emissions in 1995 (Environment Canada, 1997).

Carbon Dioxide (CO_2) emissions from agriculture are currently viewed as only those from land management practices and the burning of fuel in stationary engines, and does not include fuel for field equipment or transportation. As a result this number is low for agriculture. The combustion of fuel in field equipment and transportation is counted in the transportation sector.

Current Market Instruments

The section will outline some of the more prevalent market instruments used throughout the world. While not all of them are being used to reduce greenhouse gas emissions, same opportunities might exist. The Climate Change Task Group outlined a number of measures that could be used to reduce greenhouse gas emissions for Canada. Appendix A outlines these mitigation measures. In agriculture, for example, the Task Group concentrated on 8 items:

7.9 Reduction in summer fallow acreage
7.10 Soil tillage reduction and elimination (no-till seeding)
7.11 Increased perennial forage crop production
7.12 Improved crop yields
7.13 Reduction in methane emissions from ruminant farm animals
7.14 Reduction in emissions of Methane and Carbon dioxide from livestock manure
7.15 Reduction in emissions of GHG Gases in Association with the production of mineral nitrogen fertilizers
7.16 Reduction in fossil fuel usage for farm operations
7.17 Expand production and use of fuel ethanol

This paper will highlight three market instruments that could be used to reduce greenhouse gas emissions from agriculture:

- Substance Emissions Trading
- Carbon Credit Trading
- Conservation Easements

Substance Emissions Trading

Substance emissions trading, as accepted by the Kyoto Protocol, allows one party to purchase rights to emit greenhouse gases from another party that was able to cut its emissions below their assigned amounts (Tietenberg *et al*, 1998). A cap is usually established for all emissions of a pollutant, in this case greenhouse gases. The cap represents the total allowable amount of emissions for the area involved with the trading. Allowances, which are equal to that of the cap, are distributed among the emitters of the gases, either given or sold, depending on the structure established. Although the emitters do not necessarily receive allowances for all their initial emissions, each emitter must have enough allowances to cover its actual emissions. An emitter that fails to do so would face penalties for non-compliance.

Within the substance emissions trading system, the cap is set by an authority aside from the emissions trading market to lower emissions for the good of public health or environment. Participants in the emissions market are not required to trade their allowances, but trading can be used to lower the costs of reducing emissions, purchasing allowances from emitters who have allowances beyond their needs. Substance emissions trading works well in situations where the points of emissions are known and there are distinct emitters. The costs for an emission trading structure tend to be lower than other systems because monitoring is not required as frequently.

A number of examples of emissions trading exist, but one of the most notable examples is that of the Acid Rain Program developed in the United States to control the emissions of Sulfur Dioxide (SO_2). The program was established in 1990 and set its cap at 50 percent of the emissions in 1980. The program was developed with a known number of emitters, which in this case was relatively small. The program resulted in compliance costs considerably less than that predicted by the industry and approximately half of that predicted by the Environmental Protection Agency (Tietenberg *et al*, 1998). Initial predictions for the unit price of the allowances was between $400 and $1000, but because of the dramatic improvements within the industry, the unit price in 1995 was $150. As well, the program has reduced litigation costs, and is operated by a small regulatory staff (Tietenberg *et al*, 1998).

Another program the in United States that has been effective in reducing emissions is the Regional Clean Air Incentives Market (RECLAIM). This program was created to reduce the emissions of Nitrous Oxides and Sulfur Dioxides in Los Angeles. The RECLAIM program boasts a reduction in compliance costs from $25,000 per ton to $2000 per ton. Although the program was effective in N2O and SO2, it had difficulty establishing a cap for Volatile Organic Carbons (VOCs) (Tietenberg *et al*, 1998). The problem lied in the ability to get agreement from industry, environmentalists and other stakeholders on appropriate levels of VOCs.

Carbon Credit Trading

The credit trading systems operate slightly different than that of emissions trading. Credit trading tends to be used in areas where a reduction standard can not be used due to major differences in emitters and in particular the cost of controls are dramatically different (Tietenberg *et al*, 1998). Credits must be based on real reductions of emissions, which they must be quantifiable and go beyond all regulatory requirements.

Credit trading is project based, and each trade requires that the following be reviewed and certified; an emissions baseline, permitted level, reduction plan and enforcement mechanisms. Government or another authority is required to monitor each transaction to ensure are requirements are in place. This increases the costs of transactions. Credit trading structures are designed to have many players, including both emitters and those sequestering emissions.

There are not as many examples of credit trading, but one particularly good example is the Lead Phasedown program established by the Environmental Protection Agency (EPA) in 1982 to reduce the amount of lead in gasoline. The program was considered to be the first successful free and open trading structure. Initially, the program required that any credits generated or trade must be used within the calendar quarter, but in 1985 it was expanded to allow banking of credits. Cheating had become a problem with some companies exaggerating the amount of credit generated until the EPA increased its monitoring of transactions.

Conservation Easements

A conservation easement is a legal agreement by which a landowner voluntarily restricts or limits the type and amount of development that may take place on his or her own property. Each easement's restrictions are tailored to the particular piece of property, to take into account both the interests of the owner and the resources being protected (Nature Conservancy 1998). Conservation easements can be used to preserve wildlife habitat, open space or agricultural land, or the historic features of a building, while allowing the landowners to continue owning and using the property.

The easement holder, either a qualified conservation organization or government agency, has the right to enforce the restriction placed on the land. In addition, the easement holder has a limited right of access for inspection, scientific data collection or other purposes agreed to by the landowner. The landowner retains all rights in the property other than the ones specifically relinquished by the conservation easement. The landowner still owns the land and can use it in any way consistent with the restrictions. ~~The landowner still owns the land and can use it in any way consistent with the restrictions~~. For example, the landowner can sell the land, live on it or bequeath it by will. The landowner is obligated to pay taxes on the property and ensure that the restrictions are not violated (Nature Conservancy 1998).

Although conservation easements were not initially developed to reduce greenhouse gas emissions, benefits from the programs can be effective in reducing emissions. Several conservation programs are currently in use in Canada and in the United States. This paper will focus on Agriculture and Agrifood Canada's Permanent Cover program, the North America Waterfowl Management Plan and the Nature Conservancy.

The Permanent Cover Program (PCP) was designed to reduce soil deterioration on high-risk lands presently in annual cultivation (Wilson and Tyrchniewicz, 1995). The targeted lands were not suited for the growing of annual crops and should be permanently converted to forage and/or tree cover. The program is directed toward lands where annual cultivation is causing long-term soil damage and where special farming practices cannot reduce the ongoing deterioration. By maintaining these lands in permanent cover, the soil resource will be conserved while providing feed for livestock and habitat for wildlife. The effect of the program was to reduce tillage, resulting in less greenhouse gas emission, but also increase the potential for carbon sequestration in the soils. This program can also be viewed as a subsidy to protect the environment, as each landowner would enter into a ten or twenty-one year contract with AAFC-PFRA to maintain their land in a permanent cover.

A very similar program to the PCP is the North America Waterfowl Management Plan. The overall objective of the North American Waterfowl Management Plan (NAWMP) is to enhance and protect high quality wetland habitat in North America that supports a variety of wetland-dependent wildlife and recreational uses. Under the Plan, the objective is to have 75 percent of the funds provided by the United States, divided equally between federal and non-federal sources, and 25 percent provided by Canada, the federal government contribution being 10 percent, the contribution of the three prairie provinces being 10 percent with the remaining 5 percent coming from private sources. In practice, these shares have varied somewhat. Approximately two thirds of all Plan expenditures are spent in Canada and these are delivered through the Prairie Habitat Joint Venture.

Potential to Reduce Greenhouse Gases Emissions

This section will evaluate the potential of the different market instrument to reduce greenhouse gas emissions. Each market instrument has its own advantages and disadvantages, as well as different areas of applicability.

On a global scale the emissions trading could have the most potential. This particular instrument is already recognized by the Kyoto Protocol as one of the mechanism to reduce greenhouse gas emissions. One of the advantages of the substance emission trading system is that transaction costs are low because typically government assigns the allowances to emitters. Another advantage is that emissions can be controlled more accurately as emitters of the substance are monitored.

The disadvantage of substance trading is that there is a potential for price increases in products that contain the controlled substance. The other problem with the substance trading system is that it is difficult sometimes to negotiate the allocation of allowances.

Companies emitting the controlled substance want larger allocations, while regulatory authorities want the allowances to be reduced.

The credit trading system has the advantage of improving the economic efficiency of regulatory policies, which lowers the costs of achieving environmental goals. Another advantage is that credits do not necessarily have to be created by emissions reduction. The possibility exists to have sequestration of emissions with a credit trading system depending on how the system is structured. The disadvantage is that credit trading does not accurately control the total emissions.

The use of conservation easements for carbon credits and tradable permits have a number of possible implications. The implications are related to the fact that tradable permits would need to be based upon verifiable of greenhouse gas emissions data. For lands with existing conservation easements, gaining credits and tradable permits may not be possible. These lands existed prior to the Kyoto Protocol and therefore may not be eligible for carbon credits or tradable permit status.

The large number of land uses associated with the variety of lands with conservation easements attached to them implies there will be great difficulty in verifying the greenhouse gas emissions associated with each of the lands. Techniques to monitor the emissions will need to be very sophisticated, and accurate measurement techniques may not be available.

Conclusions

Canada needs to find market instruments that can be used effectively to reduce greenhouse gas emissions from agriculture. While each of the reviewed market instruments has their place, all require better measurement and verification than is currently available.

Matching the market instruments with the sources of emissions suggests that the land use issues related to greenhouse gas emissions might be controlled through such activities as conservation easement programs. An unpublished study by the Prairie Farm Rehabilitation Administration (PFRA) suggests that converting marginal crop land into a perennial forage has the potential to sequester carbon, as well marginally reduce greenhouse gas emissions. The study concluded that the emissions saved by not cropping the land are slightly higher than the new emissions from the addition of cattle on the land.

To reduce the methane emissions from livestock, will be difficult because measurement is not accurate currently, but there exists the potential for a crediting trading system to be developed in some areas.

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Appendix A Report of the Climate Change Task Group: Sectoral Mitigation Measures

PART I: FOUNDATION MEASURES

F1. Develop a voluntary climate challenge program
F2. Establish a national registry of voluntary mitigation actions
F3. Develop a national program of communication and motivation
F4. Establish a pilot joint implementation (JI) initiative
F5. Redirect or remove subsidies
F6. Assess a harmonized continental carbon charge among the NAFTA countries
F7. Design a tradable permits system
F8. Create a motivation fund to support measures

PART II: SECTORAL MITIGATION MEASURES

1. Residential Sector Energy Consumption Measures

The National New Building Initiative:
Residential Sector – Umbrella Program

1.1 Facilitate adoption of national building energy efficiency code
1.2 Promote energy efficiency mortgages for residential buildings
1.3 Develop a national home energy rating system (HERS) – New homes
1.4 Establish a national builder training program: Residential buildings

The National Retrofit Initiative:
Residential Sector – Umbrella Program

1.5 Create a national low income energy efficiency retrofit program
1.6 Establish retrofit building standards
1.7 Enhance financing mechanisms for home energy retrofit
1.8 Develop a national home energy rating system – existing homes
1.9 Establish a national green communities program
1.10 Develop a renovation/retrofit training program

2. Commercial Sector Energy Consumption Measures

2.1 Accelerate the application of district energy systems

National New Buildings Initiative:
Commercial Sector – Umbrella Program

2.2 Facilitate adoption of a national energy code for new commercial buildings
2.3 Promote energy efficiency mortgages: commercial buildings
2.4 Establish a national builder training program: new commercial buildings

National Retrofit Initiative:

Commercial Sector – Umbrella Program

2.5 Establish retrofit standards for commercial buildings
2.6 Improve financing mechanisms for retrofitting commercial buildings
2.7 Establish a national builder training program: commercial building retrofits
2.8 Expand the federal buildings initiative (FBI)
2.9 Expand the energy innovators initiative

3. Industrial Sector Energy Consumption Measures

3.1 Establish industrial efficiency indicators
3.2 Promote benchmarking/best practices
3.3 Implement an industrial energy innovators program
3.4 Coordinate and promote an electric drive-power challenge
3.5 Establish boiler and kiln efficiency standards
3.6 Provide a tax incentive for energy efficient industrial process investments

4. Appliance and Equipment Sector Program

4.1 Standards for appliances and equipment
4.2 Labeling for appliances and equipment
4.3 Implement a golden carrot program

5. Transportation Sector Energy Consumption Measures

5.1 National green transportation strategy

5-I Vehicle Efficiency Measures

5.2 Adopt a national inspection and maintenance program within urban areas
5.3 Apply a gas guzzler tax
5.4 Institute a national fee-bate scheme
5.5 Coordinate an accelerated retirement (vehicle salvage) program
5.6 Apply a Canadian fuel efficiency premium
5.7 Institute a fleet procurement and management program
5.8 Improve fuel efficiency standards
5.9 Increase motor fuel taxes and prices
5.10 Provide incentives for alternative transportation fuels
5.11 Implement a vehicle emission-labeling program
5.12 Implement R&D programs for advanced vehicle technologies

5-II Urban Transport Measures

5.13 Promote increased density in urban areas
5.14 Encourage telecommuting and alternative work strategies
5.15 Improve cycling and walking environment
5.16 Increase transit rider-ship
5.17 Promote ridesharing
5.18 Promote full-cost road pricing
5.19 Promote full cost parking and parking management

5-III Intercity Transportation Measures

5.20 Develop high speed rail systems for high density corridors
5.21 Enhance passenger and freight service competitiveness
5.22 A Enforce highway speeds
5.23 B Reduce highway speeds

6. Energy Supply and Production Sector Measures

6-I Electricity Supply and Demand Measures

6.1 Electric utility climate change challenge program
6.2 Integrated resource planning (IRP)
6.3 Supply side efficiency improvements
6.4 Extend demand side management (DSM) program
6.5 Electricity and heat co-generation opportunities
6.6 Investigate generation fuel switching
6.7 Evaluate increased availability of existing hydro and nuclear generation capacity
6.8 Increased non-utility generation (NUG)
6.9 Assess new low emission generation capacity

6-II Oil and Gas Supply and Demand Measures

6.10 Carbon dioxide reduction: upstream oil and gas energy efficiency improvement opportunities
6.11 Methane reduction: upstream oil and gas industry improvement opportunities
6.12 Methane reduction: downstream gas Distribution sector opportunities
6.13 Integrated resources planning (IRP) for gas distribution utilities

6-III Renewable Energy Supply Measures

6.14 Develop supporting government policies
6.15 Stimulate renewable energy markets
6.16 Develop renewable energy infrastructure
6.17 Encourage utility adoption of renewable energy
6.18 Revitalize R&D to accelerate the development of Canadian Renewable energy technologies

7. Non-Energy Sector Measures

7-I Industrial Sources and Sinks

7.1 Reduce emissions from waste landfills
7.2 Reduce methane emissions from coal mines
7.3 Control emissions of HFC's and other substitutes for ozone layer depletion substances (ODS)
7.4 Reduce emissions from aluminum smelters
7.5 Reduce emissions from an adipic acid plant
7.6 Investigate opportunities to sequester and utilize carbon dioxide

7-II Forestry Sources and Sinks

7.7 Promote Tree planting in urban and agricultural Settings

7.8 Substitute wood products for steel and concrete in the commercial building sector

7-III Agriculture

7.9 Reduction in summer fallow acreage

7.10 Soil tillage reduction and elimination (no-till seeding)

7.11 Increased perennial forage crop production

7.12 Improved crop yields

7.13 Reduction in methane emissions from ruminant farm animals

7.14 Reduction in emissions of Methane and Carbon dioxide from livestock manure

7.15 Reduction in emissions of GHG Gases in Association with the production of mineral nitrogen fertilizers

7.16 Reduction in fossil fuel usage for farm operations

7.17 Expand production and use of fuel ethanol

PART III: ADAPTATION MEASURES

Adaptation: Towards a Comprehensive Approach

1. Foundation adaptation measures
   - 1.1 Develop a public information program on adaptation
   - 1.2 Consider atmospheric change in environmental assessment processes
   - 1.3 Consider atmospheric change in the development of new technology
   - 1.4 Consider atmospheric change in the development of major infrastructure projects and the construction industry

2. Sectoral strategic and tactical adaptation measures
   - 2.1 Agriculture sector adaptation measures
   - 2.2 Water resources sector adaptation measures
   - 2.3 Forestry sector adaptation measures
   - 2.4 Hazard and coastal zone management sector adaptation measures
   - 2.5 Urban infrastructure and construction industry adaptation measures

(Climate Change Task Group, 1994)